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Computer Program (TURBLE) for Calculating Velocities and Streamlines in Turbomachines

Several recent improvements have been made in the previously developed 2DCP computer program (see Ref.) which uses finite-difference equations to solve the two-dimensional, subsonic, compressible (or incompressible), nonviscous flow problem for a rotating or stationary cascade of blades on a blade-to-blade surface of revolution. The input was simplified, the output was clarified and expanded, and the program coding was simplified and improved. The resulting program is called TURBLE.

The program is used in the design of turbomachinery blade rows, where fluid velocities in the blade-to-blade passage, particularly on the blade surfaces, must be obtained. Because the trend is to highly-loaded blading, which results in widely spaced blades, stream-filament techniques, which are only applicable in guided channels, cannot be used to obtain these velocities over the entire blade surfaces. Finite-difference equations, however, can be used to obtain a solution of the stream-function differential equation in both the guided and unguided portions of the passage.

TURBLE requires input data on blade geometry, meridional stream-channel geometry, total flow conditions, weight flow, and inlet- and outlet-flow angles.

The program operates on two principal iteration levels. The inner iteration solves the finite-difference equations of flow by successive over-relaxation. The

outer iteration then corrects the coefficients of the simultaneous equations to compensate for compressibility.

Program output includes blade surface velocities, velocity magnitude and direction throughout the passage, and streamline coordinates.

Reference:

NASA Tech Brief B68-10097, Computer Program Calculates Velocities and Streamlines in Turbomachines

Notes:

1. This program is written in FORTRAN IV (98%) and MAP (2%) for the IBM-7094 11/7044 computer.
2. Requests for further information may be directed to:

COSMIC
112 Barrow Hall
University of Georgia
Athens, Georgia 30601
Reference: B71-10392

Patent status:

No patent action is contemplated by NASA.

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